

found that it does contain a very large number of the less known names; but we are not a little surprised at the omission of the three species described in 1884 by Ringueberg in the 'Proceedings of the Academy of Natural Sciences of Philadelphia,' the same journal in which the successive parts of the 'Revision' appeared, viz. *Triacrinus pyriformis*, *T. globosus*, and *Eucalyptocrinus inconspicuous*. Ringueberg described his new genus *Triacrinus* as allied to *Hybocrinus*; but neither in the section on the Hybocrinidæ nor anywhere else in the third part of the 'Revision' can we find any mention of Ringueberg's genus.

We also miss any reference in the index to *Apiocrinus dipentus*, and likewise to *Isocrinus nobilis* and *Chladocrinus nobilis*, synonyms of the type which Waehsmuth and Springer call *Taxocrinus nobilis*; while the references which are given to two other synonyms of this species (*Poteriocrinus nobilis* and *Forbesiocrinus nobilis*) are both incorrect. It would have been better too if the names *Barrandeocrinus*, *Canistrocrinus*, and *Centrocrinus* had been placed respectively before *Barycrinus*, *Carabocrinus*, and *Ceriocrinus*, instead of after these names.

In spite of these and other errors of detail, however, many of which are no doubt due to the circumstances under which the work was prepared, as hinted on p. 299 of Part III., we have no hesitation in saying that the 'Revision of the Palæocrinoidea' is a memoir of the utmost value and importance. It will be indispensable alike to the morphologist who wishes to study the remarkable Crinoid types which flourished in the Palæozoic seas, and to the pure systematist who desires a natural classification of one of the great groups of Echinoderms—that large subkingdom in the study of which one may find some relief from the everlasting strife about the mutual relations of Worms and Arthropods, Ascidians and Vertebrates, and all the latest productions of the most advanced speculative zoology; while the stratigraphical palæontologist, who wishes to determine the age of a bed by the characters of its fossils, will find in the 'Revision' much food for reflection in the most valuable information respecting transition-forms in Crinoids and their palæontological development through a long series of strata.

P. HERBERT CARPENTER.

Catalogue of the Blastoidea in the Geological Department of the British Museum (Natural History), with an Account of the Morphology and Systematic Position of the Group, and a Revision of the Genera and Species. By ROBERT ETHERIDGE, Jun., and P. HERBERT CARPENTER, D.Sc., F.R.S., F.L.S. 4to. Pp. i-xvi, 1-322; 20 plates. London: Printed by Order of the Trustees, 1886.

A YEAR and a half ago we noticed in this Journal * a very important

* Ann. & Mag. Nat. Hist. ser. 5, vol. xv. p. 346.

work on the Stalked Crinoids *. This monograph, the result of the researches of Dr. P. Herbert Carpenter upon all the known recent species, threw a flood of light upon the morphology of the long array of fossil forms; for although the number of living representatives of the Crinoidea bears only the smallest proportion to those which are extinct, the clue they furnish renders inestimable assistance in the task of elucidating the organization of the primeval members of the race. In comparison, the difficulties that beset the path of the student of a group of animals known only as fossils, and of which no distant relatives whatever have survived to the present day, are immeasurably greater.

We have now received a monograph on the Blastoidea, another group of Echinoderms, and one to which special interest attaches from the fact that the type became altogether extinct before the close of the Palaeozoic epoch. Not a single living representative or analogue is known. On this account the Blastoidea are far more difficult to study, and the intricacies of their organization much more perplexing to unravel, than is the case in the kindred class of the Crinoidea.

Owing to the strange human tendency to value most what is rarest and most difficult to attain, the elucidation of the details of Blastoid anatomy has long been a goal towards which the aim of naturalists has been directed. It is somewhat surprising, however, that although many detached observations and descriptions of species have been published, no attempt at a complete monograph of these obscure and imperfectly-known animals has been made since the short but masterly memoir of Dr. Ferd. Roemer † in 1851. Much material and knowledge has been accumulated in the interval.

The present work is the result of seven years' constant and industrious research on the part of Mr. Robert Etheridge, Jun., and Dr. P. Herbert Carpenter. The previous publications of both authors are too well known and appreciated to need recapitulation here, and it may be unhesitatingly affirmed that the present investigation could not have been placed in more competent hands. Mr. Etheridge's extensive knowledge of fossil forms, and his carefully trained and accurate judgment would alone be a sufficient guarantee for the excellency of the work; whilst his association with such a *collaborateur* as Dr. Carpenter, who is without exception the most intimately acquainted with the morphology of recent Crinoids of any living naturalist, is a circumstance something more than fortunate. The result is that a monograph has been produced of which British naturalists may well be proud; and the Trustees of the British Museum are to be congratulated on the acquisition and publication of a most important memoir.

* "Report upon the Crinoidea collected during the Voyage of H.M.S. 'Challenger' during the years 1873-76.—The Stalked Crinoids." By P. Herbert Carpenter, D.Sc. [Report on the Scientific Results of the Voyage of H.M.S. 'Challenger.'—Zoology, part xxxii.] Published by Order of Her Majesty's Government, 1884.

† Archiv f. Naturgesch. 1851, Jahrg. xvii. Bd. i. pp. 323-397, Taf. i.-v.

The authors have been singularly fortunate in having access to an unrivalled series of specimens, the riches of the National Collection having been largely supplemented by the friendly cooperation of many English and foreign palæontologists. Most important assistance has, in this manner, been rendered by Mr. Charles Wachsmuth of Burlington, Iowa, who, with a generosity beyond all praise, unreservedly placed at the disposal of the authors an extremely valuable series of American Blastoids, selected from his own fine collection as especially adapted for the exhibition of structural characters. And it is not too much to say that by means of this friendly help it has been possible to interpret the details of many points of internal structure which could not otherwise have been satisfactorily explained at present.

The first portion of the "Catalogue" is devoted to the morphology of the Blastoids generally. This section of the work is prefaced by the zoological history of the group, and then follows an account of the structure presented by the various forms, each plate and organ being described in detail, their modifications throughout the series reviewed, and their probable functions and homologies discussed. The geological and geographical distribution of the Blastoidea is next treated of. Then follows the systematic portion of the work, in which the species and higher classificatory divisions are clearly defined and severally discussed.

The much controverted question of the relative rank which should be assigned to the Blastoidea among the other groups of Echinoderms is reviewed in a chapter marked by great clearness of judgment and logical reasoning. The authors rank the Blastoidea as a distinct class of the branch *Pelmatozoa*, which is recognized as a primary division of the *Echinodermata*, comprising the three equivalent classes *Crinoidea*, *Blastoidea*, *Cystidea*.

The following definition, embracing the result of the authors' long and careful study of the group, will give in their own words a brief conspectus of some of the important results arrived at, which for want of space we are reluctantly unable to notice :—

“ CLASS BLASTOIDEA.

“ Armless *Pelmatozoa* of a pyriform, clavate, ovate, or globose shape, which usually exhibits a very perfect radial symmetry. Base monocyclic, of two large plates and one small one, the latter being always in the left anterior interradius (A-B). Five radials, more or less deeply incised by the ambulacra, and five interradians which rest on them and bound the peristome, one of them being pierced by the anus.

“ Ambulacra fringed on each side by a single or double row of jointed appendages, which are in close relation with the side plates. These rest on or against a subambulacral lancet-plate, which is pierced by a canal that lodged the water-vessel and unites with its fellows into a circumoral ring.

“ Hydrospires arranged in ten (or rarely eight) groups, which are

limited to the radial and interradial plates ; their slits are parallel to, and more or less completely concealed by, the ambulacra, often opening externally through pores at their sides, and also by five or ten openings round the peristome. Neither hydrospires nor ambulacra extend below the basiradial suture.

“Peristome naturally concealed by a vault of small plates, which rarely exhibit any definite arrangement, and are continuous with the covering-plates of the ambulacra.”

The authors consider that “the Blastoidæ constitute a remarkably compact group which is pretty clearly marked off from the other *Pelmatozoa* ;” and they point out that the perforate lancet-plate and the regular limitation of the hydrospires to the radial and interradial plates, with their slits parallel to the ambulacra (both points of very considerable importance, as well in a morphological as in a physiological aspect), are characters which are not as yet known to occur in either the *Crinoidea* or the *Cystidea*.

Two orders, six families, and nineteen genera are defined :—

Order REGULARES, E. & C.

Pedunculate Blastoids with a symmetrical base, in which the radials and ambulacra are all equal and similar.

1st Family. *Pentremitidæ*, d'Orbigny (emend. E. & C.).

Base usually convex and often much elongated. Spiracles five, but sometimes more or less completely divided by a median septum. Their distal boundary formed by side plates. Hydrospires concentrated at the lowest part of the radial sinus.

Pentremites, Say.

Pentremitidea, d'Orbigny.

Mesoblastus, E. & C.

2nd Family. *Troostoblastidæ*, E. & C.

Ambulacra very narrow and descending sharply outwards from the much restricted peristome. Deltoids usually limited to the summit and rarely visible externally. Lancet-plate entirely covered by the side plates. Spiracles generally double, appearing as linear slits at the sides of the deltoid ridge, but not bounded distally by side plates.

Troostocrinus, Shumard.

Metablastus, E. & C.

Tricelocrinus, Meek & Worthen.

3rd Family. *Nucleoblastidæ*, E. & C.

Calyx usually globular or ovoidal, with flattened or concave base and linear ambulacra. Spiracles distinctly double, and chiefly formed by the apposition of notches in the lancet-plate and deltoids.

(i.) Subfamily ELÆACRINIDÆ, E. & C.

Elæacrinus, Roemer.

(ii.) Subfamily SCHIZOBLASTIDÆ, E. & C.

Schizoblastus, E. & C.*Cryptoblastus*, E. & C.*Acentrotremites*, E. & C.

4th Family. GRANATOBLASTIDÆ, E. & C.

Calyx globular or ovoidal, with flattened or concave base and linear ambulacra. Spiracles five, piercing the deltoids; or ten, grooving their lateral edges.

Granatocrinus, Troost.*Heteroblastus*, E. & C.

5th Family. CODASTERIDÆ, E. & C.

Base usually well developed and sometimes very long. Some, or all of the hydrosphere-slits pierce the calyx-plates on the sides of the radial sinus, restricted portions of which may remain open as the spiracles.

(i.) Subfamily PHÆNOSCHISMIDÆ, E. & C.

Codaster, McCoy.*Phænoschisma*, E. & C.

(ii.) Subfamily CRYPTOSCHISMIDÆ, E. & C.

Orophocrinus, von Seebach.*Cryptoschisma*, E. & C.

Order IRREGULARES, E. & C.

Unstalked Blastoids, in which one ambulacrum and the corresponding radial are different from their fellows. Base usually unsymmetrical.

6th Family. ASTROCRINIDÆ, T. & T. Austin
(emend. E. & C.).

(i) Basals unsymmetrical. Azygos radial small and without definite limbs; its ambulacrum short, wide, and horizontal.

Astrocrinus, T. & T. Austin.*Eleutheroocrinus*, Shumard & Yandell.

(ii) Basals symmetrical; odd ambulacrum linear.

Pentephyllum, Haughton.

The authors state that there is no certain evidence of the existence of true Blastoids anterior to the Upper Silurian period; and the type appears to have become extinct long before the close of the

Carboniferous Series, no trace of Blastoids from the Lower Carboniferous (or Calceiferous Sandstone Series), much less from any of the marine bands of the Coal-Measures, being known.

All the known Blastoids of the Upper Silurian period are confined to American strata, and represent the families Troostoblastidæ and Codasteridæ.

In the Devonian period all the families are represented. The Silurian Troostoblastidæ, however, do not appear in the American Devonian rocks; but they are well represented in Europe, although the Devonian Blastoids generally are slightly more numerous both in genera and species in America than in Europe. In Europe the great centre of Blastoid life in Devonian times appears to have been in the north of Spain, whilst in the British Isles there is but the scantiest evidence of their presence in the rocks of that period.

In the Carboniferous period ten genera are represented in Europe (all present in the British Isles), and ten, or possibly twelve, in America.

Pentremitidea, *Elvacrinus*, *Cryptoschisma*, and *Eleutheroocrinus* are found only in the Devonian.

Pentremites, *Mesoblastus*, *Tricælocrinus*, *Cryptoblastus*, *Acentrotremites*, *Heteroblastus*, *Orophocrinus*, *Astrocrinus*, and *Pentephyllum* are found only in the Carboniferous.

Of the remaining six genera, *Troostocrinus*, which appeared in the Silurian, is represented in the Carboniferous by a form which the authors think may probably be referred to it, although the genus has not yet been definitely recognized by them in the Devonian. *Codaster*, which appeared in the Silurian, passes up into the Devonian, and thence into the Carboniferous. *Metablastus*, *Schizoblastus*, and *Granatocrinus*, which occur in the Carboniferous, are represented in the Devonian by forms which the authors provisionally refer to the same genera. *Phænoschisma*, which appeared in the Devonian, passes up into the Carboniferous.

The authors remark that "The distribution of the various species of Blastoids is very limited both in Space and Time. A few species appear to be common to the Upper and Lower Devonian of America; but each of the great divisions of the Subcarboniferous in the Mississippi valley seems to have its own particular types. No Blastoid occurs on both sides of the Atlantic; one species is common to the Devonian of Spain and Germany, and another to the Carboniferous Limestone of Britain and Belgium. But with these exceptions the range of individual specific types is very limited indeed."

A list of the works consulted and a very complete index are given. The plates are most excellent, and, besides possessing great artistic merit, are especially noteworthy for the care with which the magnified details of critical points of structure are rendered.

In according our highest praise to this masterly Catalogue, we would desire to thank the authors for the boon they have conferred upon palæontologists, and also to express the hope that the much-needed monographs of the Crinoidea and Cystidea may be taken in hand by the same able and conscientious workers.